

• • R E M A R K S / A R G U M E N T S • •

The Official Action of May 21, 2004 has been thoroughly studied. Accordingly, the changes presented herein for the application, considered together with the following remarks, are believed to be sufficient to place the application into condition for allowance.

As requested by the Examiner on page 2 of the Official Action, applicant is submitting wherewith a Substitute Specification under 37 CFR §1.125 (a) together with a hand-marked-up copy of the original specification showing the changes made to the original specification.

The undersigned affirms that the Substitute Specification only contains the changes noted in the hand-marked-up copy of the original specification and does not contain any new matter.

Entry of the Substitute Specification is respectfully requested.

Also by the present Amendment the Abstract has been changed.

In addition, the claims have been changed in the manner courteously suggested by the Examiner.

Entry of the Substitute Specification, amendments to the Abstract and amendments to the claims are respectfully requested.

Claims 1-3 are pending in this application.

Claims 1 and 2 stand provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over co-pending application serial no. 10/627,267.

Claim 3 stands provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over co-pending application serial no. 10/627,267 in view of JP 2-180941.

In response to the provisional obviousness-type double patenting rejections, the undersigned notes that applicant will be filing a Terminal Disclaimer to overcome this rejection in due course and the Examiner is requested to hold this provisional rejection in abeyance until an executed Terminal Disclaimer can be obtained and submitted. (This case was recently transferred to the undersigned, who does not have a power of attorney to sign a Terminal Disclaimer for the applicant)

It is believed that the above represents a complete response to the Official Action and reconsideration is requested.

The prior art cited but not relied upon by the Examiner has been noted. This prior art is not believed to be particularly pertinent to applicants' claimed invention.

If upon consideration of the above, the Examiner should feel that there remain outstanding issues in the present application that could be resolved; the Examiner is invited to contact applicants' patent counsel at the telephone number given below to discuss such issues.

Appl. No. 10/627,267  
Amdt. Dated September 21, 2004  
Reply to Office Action of May 21, 2004

To the extent necessary, a petition for an extension of time under 37 CFR §1.136 is hereby made. Please charge the fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 12-2136 and please credit any excess fees to such deposit account.

Respectfully submitted,



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## SPECIFICATION

### RESIN COMPOSITION FOR PURGING CONTAMINANT IN THE PLASTIC PROCESSING MACHINE

#### BACKGROUND OF THE INVENTION

##### 1. Field of the Invention

The present invention relates to a resin composition for purging ~~contaminants~~ <sup>contaminants</sup> in ~~the~~ <sup>a</sup> plastic processing machine.

##### 2. Description of the Related Art

Plastics have excellent properties such as easy processability, high ~~productivity~~ <sup>productivity</sup>, light weight and relative low ~~ductivity~~ <sup>costs</sup>, so they are used for the parts and structural materials for ~~auto~~ <sup>automobiles</sup> ~~mobile~~, ~~autobicycle~~, <sup>S</sup> scooter, <sup>S</sup> television, <sup>S</sup> radio, <sup>S</sup> audio equipment, <sup>S</sup> washing machine, <sup>S</sup> rice cooker, <sup>S</sup> personal computer, <sup>S</sup> portable <sup>materials</sup> telephone, <sup>S</sup> game machinery, <sup>S</sup> building ~~mate~~ <sup>materials</sup> ~~rials~~, office supplies, stationery, <sup>S</sup> toys, sports goods, sports equipment, <sup>S</sup> agricultural <sup>agricultural</sup> ~~rials~~ ~~tools~~ and marine tools.

They <sup>these products</sup> are usually prepared by plastic processing methods such as injection ~~me~~ <sup>lding</sup>, blow molding, compression molding, transfer molding, rotating molding, slush molding, inflation tubular film process, and extrusion molding.

As plastics processing are conducted at high <sup>temperatures</sup> ~~temperature~~ above 200°C, additives, monomers, decomposed materials in the ~~materials~~ plastics are changed to carbonized ~~mate~~ <sup>materials</sup> ~~rials~~ such as tar, pitch and other <sup>color</sup> ~~color~~ <sup>colored</sup> ~~colored~~

ured, sticky substances, which are apt to adhere to the surface of the screw, ~~barrel~~ barrel and die of the plastic processing machine to cause transfer of the ~~carbon~~ carbonized materials to the molded product.

The above mentioned transfer ~~make~~ makes the ~~surfaces~~ surfaces of molded ~~products~~ products dirty and ~~make~~ makes the dimensions of the molded ~~product~~ product ~~un~~ inaccurate, resulting <sup>in failure</sup> not to perform expected moving or structural ~~functions~~ functions, therefore cleaning the screw, barrel and die of the plastic processing machine has been required.

of the plastic processing  
been required.

In case of production ~~change~~ from ~~specific~~ <sup>change</sup> ~~articles~~ <sup>articles</sup> to ~~non-colored~~ <sup>specific</sup> ~~coloured~~ ~~coloured~~ ~~molded article~~ to ~~non-colored~~ <sup>coloured</sup> or other ~~coloured~~ ~~molded article~~, ~~articles~~, cleaning the screw, barrel and die has ~~crosscontamination~~ been also required to avoid ~~crosscontamination~~ ~~caused by remained~~ specifically ~~mination~~ <sup>colored</sup> ~~coloured~~ resin compound. compound residue <sup>with</sup> ~~problems~~ <sup>problems</sup> ~~the~~

However, there are some problems on the conventional cleaning method of the screw, barrel and die.

One conventional cleaning method has been known as the ~~method~~ <sup>involves</sup> of dismantling the plastic processing machine, resulting in ~~exposing~~ exposing the screw, barrel and die to the outside, then the carbonized material or <sup>colored</sup> ~~coloured~~ materials adhered to the surface of the screw, barrel and die ~~are~~ removed by using ~~the~~ <sup>a</sup> separating tools ~~tool~~ such as knife.

such as knife.

However, this method has a defect of exposing ~~operator~~<sup>operators</sup> to high ~~temperature~~<sup>temperatures</sup> and taking long times, which often causes ~~some~~<sup>some often</sup> ~~operator's~~<sup>operator's</sup> suffering of skin burn and ~~operator~~<sup>operators</sup> to suffer ~~burn~~<sup>burns</sup>

or electric shock. sized processing

In the case of a large size plastic processing machine, dismantling is impossible.

There are known other conventional cleaning methods in which uncoloured thermoplastic resin such as low density polyethylene is passed through the inside of the plastic processing machine. Such methods cannot remove contaminants entirely even if used over extended times. Moreover, such methods generate a large amount of mixed product consisting of contaminants and resin, which scarcely find use as the recycling resin compound.

Another cleaning method is the method of using the resin composition containing calcium carbonate which exerts improved effect on the removal of coloured contaminants. However, it causes new problem of remaining the inorganic powder in the plastic processing machine.

Another cleaning method also has been attempted by using a resin composition consisting of a thermoplastic resin such as low density polyethylene and a surface active agent such as sodium stearate or polyoxyethylene nonylphenyl ether having the effect of lowering interface tension. However, the coloured contaminants were scarcely removed.

Based on the above mentioned knowledge, new cleaning methods have been disclosed in the Japanese Kokai Patents (H2-180941 and H7-53774), in which it is disclosed

uncolored  
a resin composition consisting of ~~uncolored~~  
~~thermoplastic~~ resin and a calcium  
salt of <sup>an</sup> organic boron compound having  $\text{sp}^3$  hybridization orbitals. <sup>thus</sup> resin composition  
which maintains a certain ~~extent~~ amount  
of abrasive property. ~~Properties~~ <sup>does</sup>

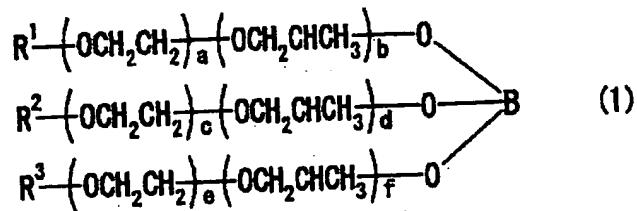
However, the method ~~is still~~ not ~~ever~~ ~~ever~~  
~~its~~ sufficient effect of removing the  
~~coloured contaminant~~ <sup>a</sup> colored contaminants

## SUMMARY OF THE INVENTION

As a result of diligent investigation <sup>during the course of</sup>  
~~by~~ the present invention, ~~under such sit~~  
~~uation~~, the present invention provides a ~~contaminates~~  
resin composition for purging away ~~cont~~ <sup>contaminates</sup>  
~~aminant~~ in the plastic processing ~~mach~~  
~~which resin composition comprises~~ <sup>machines</sup>  
~~be comprizing~~ a thermoplastic resin and <sup>polyoxyalkylene</sup>  
a specific borate ester of <sup>polyoxyalky</sup>  
~~the present invention further provides~~ <sup>purging contaminants</sup>  
~~ene~~ and a purging method of <sup>contamina</sup>  
at in the plastic processing ~~mach~~ <sup>machines</sup> which  
by passing said resin composition throu <sup>involves</sup>  
gh inside of the plastic processing ~~mac~~  
~~hine~~ machines

## DETAILED DESCRIPTION OF THE INVENTION

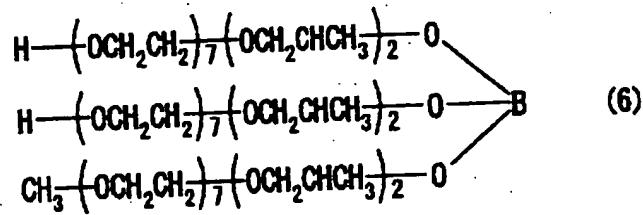
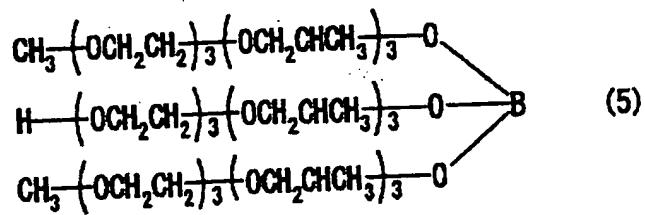
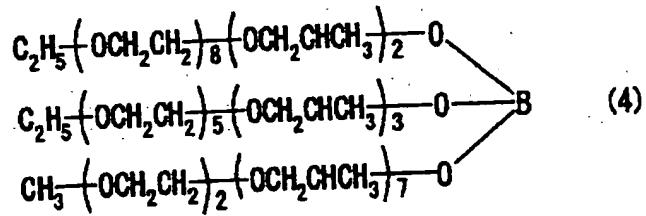
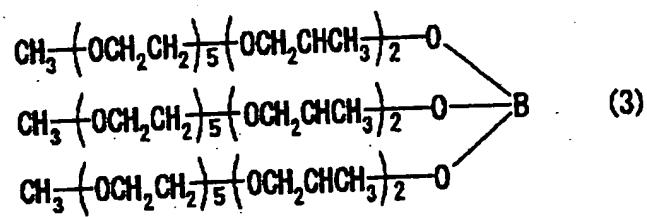
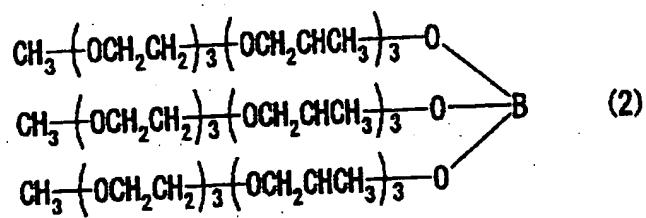
The <sup>chemical</sup>  
A borate ester of polyoxyalkylene used for the present invention is a ~~che~~  
~~rical~~ compound expressed by the following  
general formula (1). <sup>following</sup>

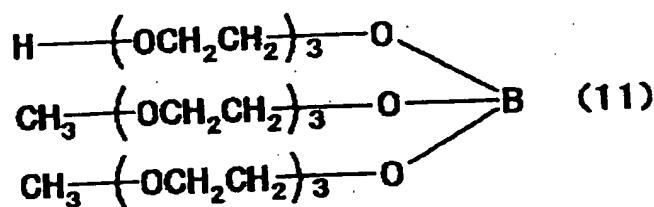
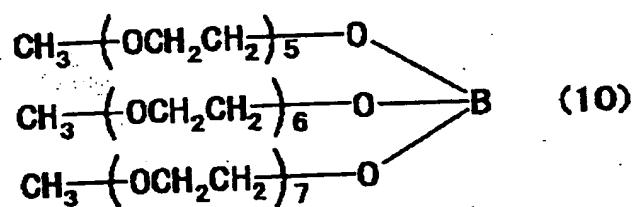
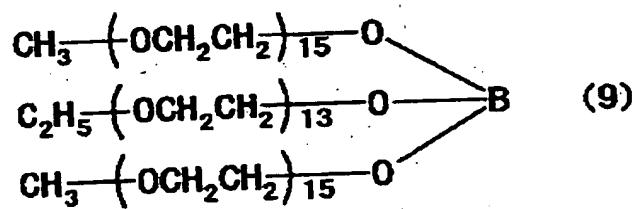
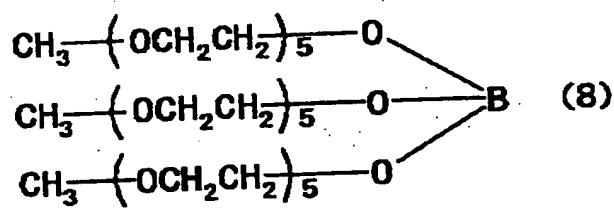
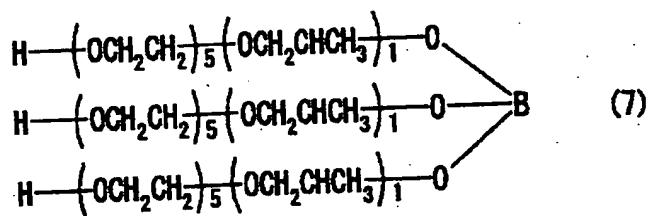


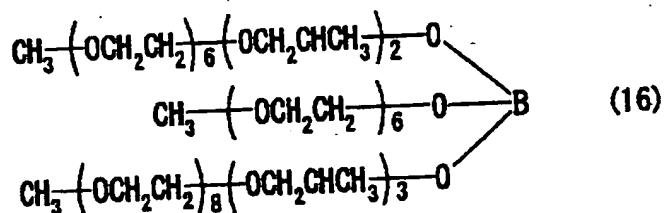
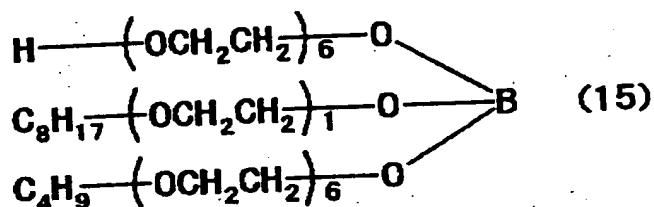
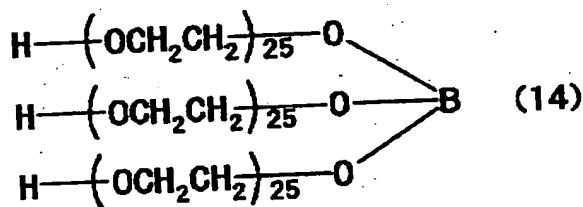
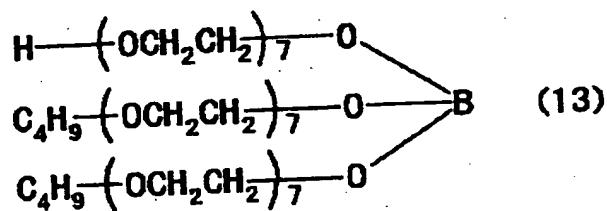
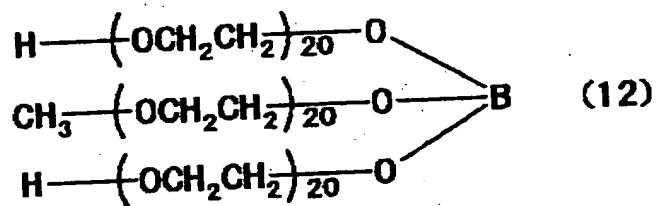
wherein  $R^1$ ,  $R^2$  and  $R^3$  are independently selected from the group consisting of hydrocarbons and hydrocarbon groups,  $a$ ,  $b$ ,  $c$ ,  $d$ ,  $e$  and  $f$  are positive integers independently selected from 0 to 30 whose sum is from 6 to 80.

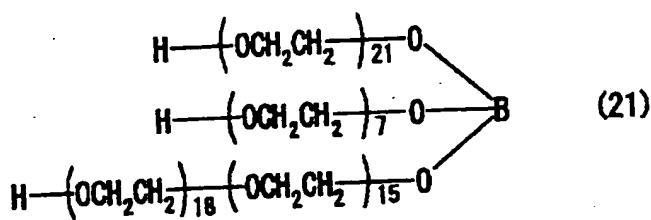
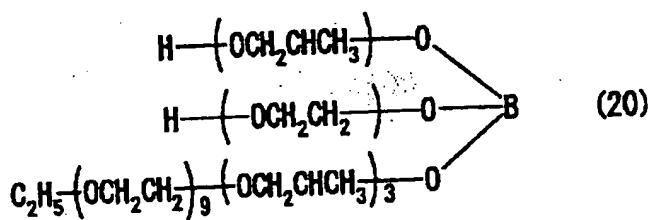
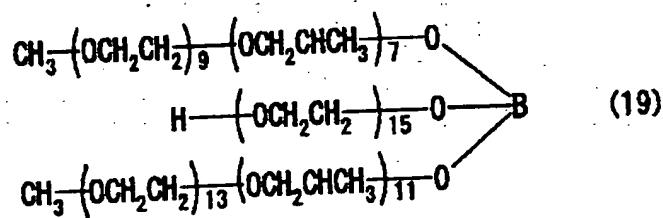
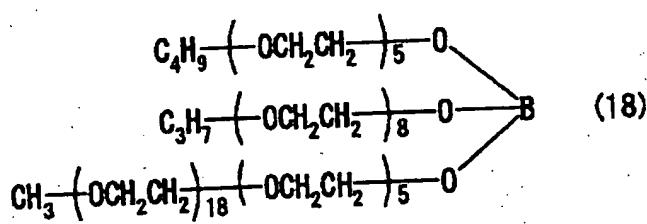
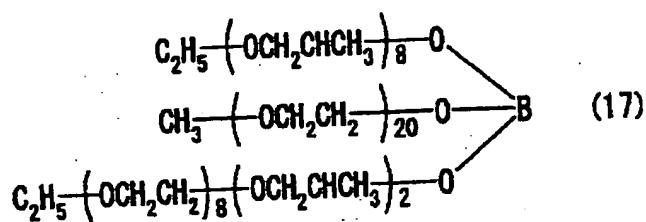
Examples of the hydrocarbon groups are alkyl groups such as methyl, ethyl, propyl, isopropyl, butyl, pentyl, hexyl, octyl, nonyl, decyl, dodecyl, hexadecyl, octadecyl and docosyl groups and phenyl, tolyl and cyclohexyl groups.

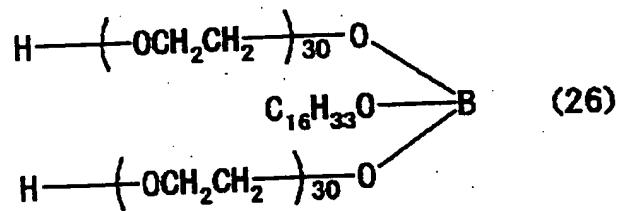
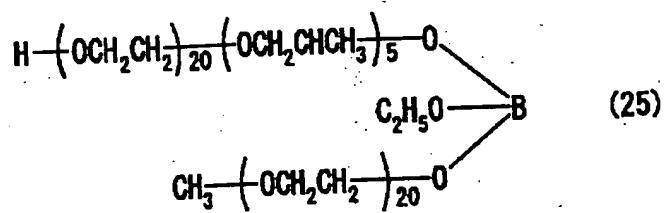
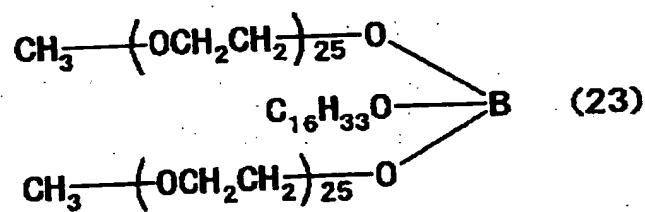
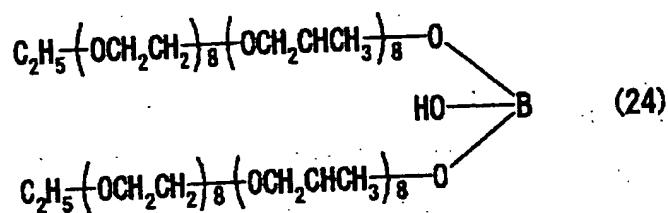
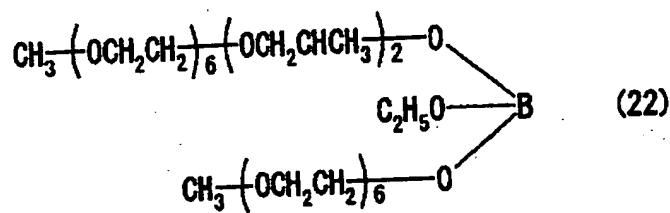
Illustrative of the borate ester of polyoxyalkylene are the chemical compound expressed by the following chemical formula from (2) to (27).

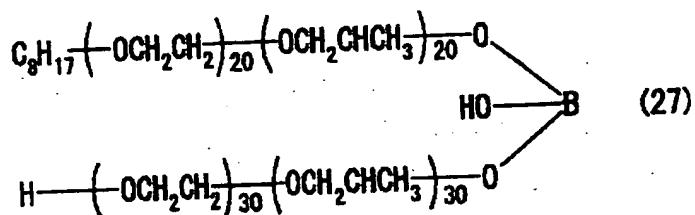












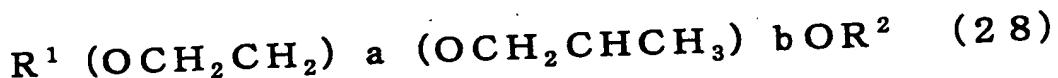
Production method for the borate esters of polyoxyalkylene used for the present invention are not limited to any specific method, however, the following method is preferable.

The borate esters of polyoxyalkylene are produced by esterification-dehydration condensing reaction by contacting polyoxyalkylene expressed by the chemical formula (28) with boric acid or borate esters of lower alcohol such as methyl alcohol or ethyl alcohol.

It is preferable that the reaction is carried out by using 1 mol of boric acid or borate esters of lower alcohol with from 3 to 3.5 moles of polyoxyalkylene expressed by the chemical formula (28).

If the mole ratio is less than 3, it is not preferable because undesirable byproducts of borate esters having two or three boron atoms are generated.

The other byproducts or unreacted polyoxyalkylene may be remained in the borate esters unless they do not hinder the purging effect of the resin composition of the present invention.



selected  
wherein  $R^1$  and  $R^2$  are independently selected from the group consisting of hydrogen and hydrocarbon group,  $a$  and  $b$  are independently selected from 0 to 30. <sup>hydrogen</sup> <sup>independently</sup>

~~Examples~~ of the hydrocarbon group are alkyl groups such as methyl, ethyl, ~~prop-~~ <sup>propyl</sup> ~~yl~~, isopropyl, ~~butyl~~ <sup>butyl</sup>, pentyl, hexyl, octyl, nonyl, decyl, dodecyl, hexadecyl, octadecyl and docosyl groups and phenyl, tolyl and cyclohexyl group.

~~Examples~~ of the polyoxalkylene ~~expressed~~ expressed by the chemical formula (28) are as follows:

diethylene glycol monomethyl ether,  
diethylene glycol monoethyl ether,  
diethylene glycol monoisopropyl ether,  
diethylene glycol monobutyl ether,  
diethylene glycol monoocethyl ether,  
diethylene glycol monodecyl ether,  
diethylene glycol monohexadecyl ether,  
diethylene glycol monooctadecyl ether,

triethylene glycol monomethyl ether,  
triethylene glycol monoethyl ether,  
triethylene glycol monoisopropyl ether,  
triethylene glycol monobutyl ether,  
triethylene glycol monoocethyl ether,  
triethylene glycol monodecyl ether,  
triethylene glycol monohexadecyl ether,  
triethylene glycol monoocadecyl ether,

tetraethylene glycol monomethyl ether,  
tetraethylene glycol monoethyl ether,  
tetraethylene glycol monoisopropyl ether,  
tetraethylene glycol monobutyl ether,

tetraethylene glycol monooctyl ether,  
tetraethylene glycol monodecyl ether,  
tetraethylene glycol monohexadecyl ether,  
tetraethylene glycol monooctadecyl ether,

polyethylene glycol monomethyl ether,  
polyethylene glycol monoethyl ether,  
polyethylene glycol monoisopropyl ether,  
polyethylene glycol monobutyl ether,  
polyethylene glycol monooctyl ether,  
polyethylene glycol monodecyl ether,  
polyethylene glycol monohexadecyl ether,  
polyethylene glycol monoctadecyl ether,

dipropylene glycol monomethyl ether,  
dipropylene glycol monoethyl ether,  
dipropylene glycol monoisopropyl ether,  
dipropylene glycol monobutyl ether,  
dipropylene glycol monooctyl ether,  
dipropylene glycol monodecyl ether,  
dipropylene glycol monohexadecyl ether,  
dipropylene glycol monoctadecyl ether,

tripropylene glycol monomethyl ether,  
tripropylene glycol monoethyl ether,  
tripropylene glycol monoisopropyl ether,  
tripropylene glycol monobutyl ether,  
tripropylene glycol monooctyl ether,  
tripropylene glycol monodecyl ether,  
tripropylene glycol monohexadecyl ether,  
tripropylene glycol monoctadecyl ether,

tetrapropylene glycol monomethyl ether,  
tetrapropylene glycol monoethyl ether,  
tetrapropylene glycol monoisopropyl  
ether,

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F

tetrapropylene glycol monobutyl ether,  
tetrapropylene glycol monoocethyl ether,  
tetrapropylene glycol monodecyl ether,  
tetrapropylene glycol monohexadecyl  
ether,  
tetrapropylene glycol monoocotadecyl  
ether,

polypropylene glycol monomethyl ether,  
polypropylene glycol monoethyl ether,  
polypropylene glycol monoisopropyl ether,  
polypropylene glycol monobutyl ether,  
polypropylene glycol monoocethyl ether,  
polypropylene glycol monodecyl ether,  
polypropylene glycol monohexadecyl ether,  
polypropylene glycol monoocotadecyl ether,

diethyleneglycol tripropyleneglycol  
monomethyl ether,  
tetraethyleneglycol dipropyleneglycol  
monomethyl ether,  
tetraethyleneglycol tripropyleneglycol  
monomethyl ether,  
tetraethyleneglycol tetrapropyleneglycol  
monomethyl ether,  
pentaethyleneglycol dipropyleneglycol  
monomethyl ether,  
pentaethyleneglycol tripropyleneglycol  
monomethyl ether,  
diethyleneglycol tetrapropyleneglycol  
monomethyl ether,

hexaethyleneglycol dipropyleneglycol  
monomethyl ether,  
hexaethyleneglycol dipropyleneglycol  
monomethyl ether,

hexaethyleneglycol tripropyleneglycol  
monomethyl ether,  
hexaethyleneglycol tetrapropyleneglycol  
monomethyl ether,  
hexaethyleneglycol pentapropyleneglycol  
monomethyl ether,  
hexaethyleneglycol hexapropyleneglycol  
monomethyl ether,

heptaethyleneglycol dipropyleneglycol  
monomethyl ether,  
heptaethyleneglycol dipropyleneglycol  
monomethyl ether,  
heptaethyleneglycol tripropyleneglycol  
monomethyl ether,  
heptaethyleneglycol tetrapropyleneglycol  
monomethyl ether,  
heptaethyleneglycol pentapropyleneglycol  
monomethyl ether,  
heptaaethyleneglycol hexapropyleneglycol  
monomethyl ether,  
heptaaethyleneglycol heptapropyleneglyc-  
ol monomethyl ether,

octaethyleneglycol dipropyleneglycol  
monomethyl ether,  
octaethyleneglycol tripropyleneglycol  
monomethyl ether,  
octaethyleneglycol tetrapropyleneglycol  
monomethyl ether,  
octaethyleneglycol pentapropyleneglycol  
monomethyl ether,  
octaethyleneglycol hexapropyleneglycol  
monomethyl ether,  
octaethyleneglycol heptapropyleneglycol  
monomethyl ether,

polyethyleneglycol polypropyleneglycol  
monomethyl ether,

triethylene glycol,  
tetraethylene glycol,  
pentaethylene glycol,  
hexaethylene glycol,  
heptaethylene glycol,  
octaethylene glycol,  
decaethylene glycol,  
tridecaethylene glycol,  
hexadecaethylene glycol,  
eicosaethylene glycol,  
pentacosaeethylene glycol,  
triacosaeethylene glycol,

tripropylene glycol,  
tetrapropylene glycol,  
pentapropylene glycol,  
hexapropylene glycol,  
heptapropylene glycol,  
octapropylene glycol,  
decapropylene glycol,  
tridecapropylene glycol,  
hexadecapropylene glycol,  
eicosapropylene glycol,  
pentacosapropylene glycol,  
triacosapropylene glycol,

triethylene glycol tripolypropylene glycol,  
tetraethylene glycol dipropylene glycol,  
tetraethylene glycol tripolypropylene glycol,  
tetraethylene glycol tetrapropylene glycol,  
pentaethylene glycol dipropylene glycol,  
pentaethylene glycol tripolypropylene glycol,

hexaethylene glycol dipropylene glycol,  
hexaethylene glycol tripropylene glycol,  
hexaethylene glycol pentapropylene  
glycol,  
hexaethylene glycol hexapropylene glycol,  
heptaethylene glycol dipropylene glycol,  
triacosaethylene glycol dipropylene  
glycol,

heptaethylene glycol tripropylene glycol,  
heptaethylene glycol tetrapropylene  
glycol,  
heptaethylene glycol pentapropylene  
glycol,  
heptaethylene glycol hexapropylene  
glycol,  
heptaethylene glycol heptapropylene  
glycol,

octaethylene glycol dipropylene glycol,  
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octaethylene glycol tetrapropylene  
glycol,  
octaethylene glycol pentapropylene  
glycol,  
octaethylene glycol hexapropylene glycol,  
octaethylene glycol pentapropylene  
glycol,  
octaethylene glycol octapropylene glycol,  
polyethylene glycol polypropylene glycol,

tripropylene glycol triethylene glycol  
monomethyl ether,  
tetrapropylene glycol diethylene glycol  
monomethyl ether,  
tetrapropylene glycol triethylene glycol

monomethyl ether,  
tetrapropylene glycol tetraethylene glycol monomethyl ether,  
pentapropylene glycol diethylene glycol monomethyl ether,  
pentapropylene glycol triethylene glycol monomethyl ether,  
pentapropylene glycol tetraethylene glycol monomethyl ether,  
hexapropylene glycol diethylene glycol monomethyl ether,  
hexapropylene glycol triethylene glycol monomethyl ether,  
hexapropylene glycol tetraethylene glycol monomethyl ether,  
hexapropylene glycol pentaethylene glycol monomethyl ether,  
hexapropylene glycol hexaethylene glycol monomethyl ether,  
heptapropylene glycol diethylene glycol monomethyl ether,  
heptapropylene glycol triethylene glycol monomethyl ether,  
heptapropylene glycol tetraethylene glycol monomethyl ether,  
heptapropylene glycol pentaethylene glycol monomethyl ether,  
heptapropylene glycol hexaethylene glycol monomethyl ether,  
heptapropylene glycol heptaethylene glycol monomethyl ether  
octapropylene glycol diethylene glycol monomethyl ether,

octapropylene glycol triethylene glycol monomethyl ether,

octapropylene glycol tetraethylene glycol monomethyl ether,

octapropylene glycol pentaethylene glycol monomethyl ether,

octapropylene glycol hexaethylene glycol monomethyl ether,

octapropylene glycol heptaethylene glycol monomethyl ether

octapropylene glycol octaethylene glycol monomethyl ether

polypropylene glycol polyethylene glycol monomethyl ether

tripropylene glycol triethylene glycol monomethyl ether,

tetrapropylene glycol triethylene glycol monomethyl ether,

tripropylene glycol triethylene glycol monomethyl ether,

octapropylene glycol diethylene glycol monomethyl ether,

octaethylene glycol dipropylene glycol monomethyl ether,

octaethylene glycol tripropylene glycol monomethyl ether,

octaethylene glycol tetrapropylene glycol monomethyl ether,

octaethylene glycol pentapropylene glycol monomethyl ether,

octaethylene glycol hexapropylene glycol monomethyl ether,

octaethylene glycol heptapropylene glycol monomethyl ether,

octaethylene glycol octapropylene glycol monomethyl ether,

polyethylene glycol polypropylene glycol monomethyl ether.

A solvent or diluent may be incorporated into the raw materials such as boric acid, borate ~~ester~~ of lower ~~alcohol~~ and polyoxalkylene, or into borate esters of glycol ether.

If the solvent or diluent are employed, they must not disturb the esterification <sup>15</sup> dehydration or ester-exchange reaction and their boiling point <sup>points</sup> are preferable ~~be below~~ <sup>should</sup> below the boiling point of the byproducts or polyoxalkylenes.

Examples of the solvent or diluent are ethers such as diethyl ether, dioxane, tetrahydrofuran; aliphatic hydrocarbons such as hexane, acetic anhydride, heptane, octane, nonane, decane, undecane; aromatic hydrocarbons such as benzene, toluene, xylene; cycloalkanes such as cyclohexane, cyclohexene; non-proton polar compounds such as dimethyl formamide, dimethyl sulfoxide, hexamethyl polyamide phosphate, acetonitrile, N-methyl pyrro-pyrrolidone lidone; and their chlorine substituted compounds such as chloroform and carbon tetrachloride.

A catalyst for the esterification-dehydration or ester-exchange reaction may be used.

If the catalysts are necessary for promoting the reaction, following condensation catalysts are recommended.

Example of the catalysts are metallic Examples

Salt Acid Octanoate  
salt of organic acid such as ferrous octanoate, ferrous naphthenate, cobaltous naphthenate, manganese octanoate, stannum octanoate, stannum naphthenate, lead octanoate, lead naphthenate, organotin compounds such as dibutyl tin diacetate, dibutyl tin dioctanoate, dibutyl tin dilaurate, dibutyl tin dioleate, dibutyl tin dimethoxide, oxidized dibutyl tin; metal alcoholate such as tetrabutyl titanate, tetrabutyl zirconate; titanium chelate such as di-isopropoxy bis-acetyl acetonate titanium, 1, 3-propanedioxy bis-ethyl acetonate titanium, 1, 3-propanedioxy bis-ethyl acetoacetate titanium; aluminum chelate such as aluminum acetylacetate, aluminum chelate such as aluminum acetylacetate, aluminum tris-ethyl acetoacetate; amines such as hexyl amine, dodecylamine phosphate, dimethyl hydroxyamine, diethyl hydroxyamine; tetra-ammonium inorganic salt such as benzyl hydroxyamine; inorganic acids such as hydrochloric acid, nitric acid, sulfuric acid, phosphoric acid; organic acid such as acetic anhydride, pure acetic acid (over 99.8%), propionic acid, citric acid, benzoic acid, formic acid, acetic acid, oxalic acid, p-toluenesulfonic acid; chlorosilane chlorosilanes such as methyl tri-chlorosilane, dimethyl di-chlorosilane; inorganic base such as aqueous ammonia; organic base such as ethylene diamine, tri-ethanol amine; and amino alkylamine.

It is preferable that the esterification reaction is carried out under ~~the~~ conditions

pressures and at a temperature of at reduced or atmospheric pressure, and preferably from 50 to 250°C, temperature, favourably from 100 to 180°C.

~~Under the reaction, removal of byproducts such as lower alcohol or water can proceed the reaction easily because removal of byproducts~~ <sup>alcohol(s)</sup> ~~proceeds~~ <sup>proceeds</sup> the reaction ~~of equilibrium to favorable direction of~~ <sup>and favor</sup> ~~formation~~ <sup>formation</sup> ~~ion.~~ <sup>method</sup>

As to the removal ~~method~~, azeotropic distillation using <sup>an</sup> azeotropic agent and batch or continuous distillation using a distillation tower are preferable.

For the purpose of improving the properties of the borate ester of polyoxalkylenes, amino group containing compound and/or <sup>solvent</sup> ~~solvent~~ may be added to said borate esters of polyoxalkylenes.

Adding the amino group containing compound to the borate ester of polyoxalkylenes exhibits the suppressing of borate ester hydrolysis and also exhibits a rust preventive effect under the condition of <sup>the presence</sup> ~~the presence~~ of water or its vapor.

Examples of the amino-group containing compound include alkylamine, <sup>cyclic</sup> ~~cyclic~~ alkylamine, alkanol amine, heterocyclic amine, diamine, lactam, cyclic imide and poly-amine, which may be used alone or combination, selecting from these compound.

As the alkyl amine, there can be used methyl amine, dimethyl amine, trimethyl amine, ethyl amine, diethyl amine, triethyl amine, propyl amine, N, N-di[poly(4-oxyethyl) hexadecyl amine, dodecyl dime-

*polyoxalkylenes*

thyl amine, stearamide propyl dimethyl amine, polyoxyethylene (3-30) octadecyl amine, polyoxyethylene (3-30) lauryl amine, polyoxyethylene (3-30) oleyl amine, polyoxyethylene (3-30) dilauryl amine, polyoxyethylene (3-30) stearyl amine, polyoxyethylene (3-30) alkyl amine, polyoxyethylene (3-30) dialkyl amine, and di(oleoyloxyethyl) hydroxy amine.

As the cycloalkyl amine, there can be used cyclohexyl amine, methyl cyclohexyl amine and ethyl cyclohexyl amine.

As the alkanol amine, there can be used ethanol amine, diethyl hydroxy methyl amine, diethanol amine, dimethyl amino ethanol, triethanol amine, propanolamine, dimethyl 2-hydroxypropyl amine, butanol amine, methyl di(2-hydroxyethyl) amine, tri(2-hydroxyethyl) amine, hydroxymethyl di(2-hydroxyethyl) amine, dibenzil 2-hydroxypropyl amine and cyclohexyl di(2-hydroxyethyl) amine.

As the cycloalkanol amine, there can be used cyclohexanol amine, methylcyclohexanol amine and ethylcyclohexanol amine.

As the heterocyclic amine, there can be used ~~used~~ pyridine, lutidine, 3, 4-xylidine, piperidine, N-methyl piperidine and N-ethyl piperidine.

As the lactam, there can be used propio lactam, N-methylpropio lactam, N-ethyl butyro lactam, N-methyl varero lactam, N-methyl caprolactam and phenyl caprolactam.

As the cyclic imide, there can be used

succinimide, N-methyl succinimide, N-ethyl succinimide, phenyl succinimide and 2-undecyl imidazoline.

As the diamine, there can be used ethylene diamine, triethylene diamine and tetraethylene diamine.

As the polyamine, there can be used diethylene triamine, triethylene tetraamine and pentaethylene pentamine.

Among these ~~amine group~~ containing compounds, tertiary ~~amine group~~ containing compound exhibit excellent effect of preventing hydrolysis of borate ester of polyoxyalkylene and promoting the cleaning and purging the coloured ~~contamination~~ <sup>cleaning</sup> ~~contamination~~ <sup>compounds</sup>.

Examples

Example of tertiary ~~amine group~~ containing compounds having the above mentioned excellent properties are polyoxyethylene (3-30) octadecyl amine, polyoxyethylene (3-30) lauryl amine, polyoxyethylene (3-30) oleyl amine, polyoxyethylene (3-30) stearyl amine, polyoxyethylene (3-30) alkyl amine, polyoxyethylene (3-30) dialkyl amine and di(oleoyloxyethyl) hydroxy amine.

The amount of ~~amine group~~ containing borate compound to 100 parts by weight of borate ester of polyoxyalkylene is from 0 to 100 parts by weight, <sup>and preferably</sup> ~~and preferably~~ from 5 to 50 parts by weight and most favourable from 10 to 30 parts by weight.

Use of ~~the~~ solvent contributes to lower viscosity of the borate ester of polyoxyalkylene.

As ~~the~~ solvent, there can be used

water, methyl alcohol, ethyl alcohol, isopropyl alcohol, butyl alcohol, isopropyl ether, ether, ethylene glycol, polyethylene glycol, polyethylene dimethyl ester, diethylene glycol, triethylene glycol, ethylene glycol dimethyl ether, diethylene glycol dimethyl ether, diethylene glycol diethyl ether, ethylene glycol dipropyl ether, triethylene glycol dimethyl ether, triethylene glycol monoethyl ether, diethylene glycol monobutyl ether, diethylene glycol diethyl ether, diethylene glycol propyl ether, diethylene glycol dibutyl ether, dimethyl ether, propylene glycol, acetone, methylethyl ketone, furfural, dioxane, methane sulfonate, diethyl ether, tetrahydrofuran, hexane, acetic anhydride, heptane, octane, nonane, decane, undecane, benzene, toluene, xylene, cyclohexane, cyclohexene, dimethyl formamide, dimethyl sulfoxide, hexamethyl triamide phosphate, acetonitrile, N-methyl pyrrolidone, chloroform and carbon tetrachloride and the solvents are used by alone or combination.

The amount of solvent to 100 parts by total weight of borate ester of polyoxyalkylene and amino-group containing compound are from 0 to 100 parts by weight, and preferably from 5 to 50 parts by weight and most favourably from 10 to 30 parts by weight. *preferably* *Ingredients*

The other ingredient other than amino-group containing compound and/or solvent may be incorporated to borate ester of into

G

Improving

polyoxyalkylene for the purpose of improving the properties of cleaning and purging ~~the~~ resin compound of the present invention. according to

As ~~the~~ other ingredients, there can be used stabilizer, neutralizer, antioxidant, ultraviolet absorber, light stabilizer, antistatic agent, lubricant, processability improving agent, fillers, dispersing agent, coupling agent, anti-copper rusting agent, blowing agent, nuclear deformer, forming agent, anti-forming agent, defoamer, colorants, pigments, dyeing agent, carbon black, water tree preventing agent, voltage stabilizer, anti-tracking agent, organic peroxide, crosslinking agent, disinfectant, antiseptics, anti-mold agents and anti-rust agents.

In the present invention, the resin composition for purging ~~contaminant~~ ~~contaminants~~ from a plastic processing machine means the resin composition which is fed from a hopper into the inside vacaney of the plastic processing machine to fill the vacaney with the resin composition.

The vacaney of plastic processing machine had previously been filled with other resin composition for producing the plastic mold or film and the surface of screw barrel and die had become ~~contaminated~~ ~~contaminated~~ coloured sticky contaminant formed by decomposition of the resin.

In case of long time operation or when resin composition changing for producing other sort of plastic article, remained the product of previous resin composition used for previous product and the contaminant caused by products

long time operation must be purged for new plastic article production to prevent cross-contamination. <sup>before</sup> ~~holder~~ ~~used~~ prevent

The resin composition for purging ~~contaminants~~ <sup>residual</sup> ~~composition(s)~~ previously used resin composition is fed into plastic processing machine after previous plastic article production is over.

The resin composition for purging may be continuously fed <sup>used</sup> into the processing machine after the resin composition is filled the vacancy of the plastic processing machine.

After the resin composition for purging is filled, then switch off the heat source and lower the machine temperature to room temperature and leaves the resin composition <sup>remains in the processing machine</sup> for sufficient time such as from 6 to 48 hours to contact with contaminants and residue of previously used resin composition. <sup>previously</sup> ~~product~~ ~~composition(s)~~.

When the next plastic mold or film composition will be produced, the new resin composition for next plastic mold or film will be fed into the plastic processing machine, then any <sup>remaining</sup> ~~purge~~ resin composition absorbed <sup>having</sup> with contaminant will be exhausted purged. <sup>absorbed therein</sup>

The resin used for the resin composition of present invention is the thermoplastic resin.

As the thermoplastic resin, there can be used high density polyethylene, high pressure low density polyethylene such as HP-LDPE, EVA, EEA, Ionomer, olefin vinyl alcohol copolymer, LLDPE, VLDPE, polypropylene (PP), polystyrene (PS), polystyrene

styrene copolymer  
acrylonitrile-butadiene-styrene copolymer (ABS), acrylonitrile-styrene copolymer (AS), acrylonitrile-butadiene copolymer, acrylonitrile acrylate-styrene copolymer, polyvinyl chloride (PVC), polyamide, poly-methylmethacrylate (PMMA), polyacetal (POM), aminopolyacrylamide, polyarylate, fluoro-carbon resin, polyimide (PI), polyamine-bismaleimide (PABI), polyamideimide (PAI), polyetherimide (PEI), bismaleimidetriazine resin (BT), polysulfone, polybutylene terephthalate (PBT), polyethylene terephthalate (PET), polyvinylidene chloride, polycarbonate (PC), polyvinyl acetate, polyvinyl alcohol, polyvinyl ether, polyvinyl formate, modified PPE, modified polyphenyleneoxide (PPO), polyphenylene sulfide (PPS), polyethersulfone (PESF), polyetheretherketone (PEEK), polyarylsulfone (PAS), polymethylpentene (TPX), liquid crystal polymer, silicone resin, natural rubber (NR), butyl rubber (IIR), acrylonitrile-butadiene rubber (NBR), chloroprene rubber (CR), styrene butadiene rubber (SBR), butadiene rubber (BR).

<sup>The</sup> production method of the resin composition for purging away contaminants according to the present invention is not limited to any specific method; however, the following method is desirable.

To the 100 parts by weight of a thermoplastic resin, 0.1~10 parts by weight of a borate ester of glycol ether expressed by general formula (1) is added.

The form of the thermoplastic resin may be powder or pellet form.

in  
of a

The borate ester of polyoxyalkylenes may be soaked into thermoplastic resin powder or pellet. *the soaking*

~~The soaking~~ *It* is desirable to conduct, at ~~a~~ the temperature of over the glass transition point ~~so that~~ because at the temperature soaking speed is fast. *producing*

~~The other production method for, purging resin composition of the present invention~~ *Another* ~~composition~~ *invention* may be conducted as follows.

The thermoplastic resin and borate ester of polyoxyalkylenes are fed ~~so into~~ a plastic processing machine or bunbury mixer, in which they are blended and extruded ~~from~~ *through* a pelletizing die having many ~~holes~~ of 3~7mm diameter.

Each extruded ~~strings~~ *String 15* ~~pellets~~ are cut to form ~~pellet~~ having the length of 3~7mm.

In case the amount of the borate ester of polyoxyalkylenes is less than 0.1 parts by weight, the resin composition for purging does not exhibit the cleaning and purging effect. *If on the other hand the amount of the borate ester of polyoxyalkylenes* is more than 10 % parts by weight, it is not desirable because the uniform polymer blend is barely obtained. *15*

## EXAMPLE

Now, the resin ~~composition~~ *composition* for purging away ~~contaminant~~ *contaminant* in the plastic processing machine according to the present invention will be described in further detail with reference to ~~Example~~ *specific Examples*.

However, it ~~should~~ be understood that *should*

the present invention is by no means restricted by such specific Example. *Examples*

### Example 1

Borate ester of polyoxyalkylene expressed by chemical formula (2) was obtained by following synthesis process.

In a 7000 ml flask equipped with three inlet pipes and displaced by nitrogen gas were charged 146g (1 mole) of triethyl borate  $[B(OC_2H_5)_3]$ , 1.2g of dibutyl tin dilaurate and 50 ml of benzene.

Subsequently, to the solution in the flask was added with 996g (3 mole) of tripropylene glycol triethylenglycol monomethyl ether under stirring conditions to obtain uniform blended solution.

Subsequently, the solution in the flask was stirred for 13 hours at  $95^{\circ}C$  under the condition of distillation to remove ethanol and benzene as the byproduct to obtain 1002g (0.99 mole) of a borate ester of polyoxyalkylene expressed by chemical formula (2).

In a vessel, 99.0 parts by weight of a high pressure low density polyethylene (made by Nippon Unicar Company Ltd., melt mass flow rate 1.2g/10 min., density 0.923 g/cm<sup>3</sup>) and 1.0 parts by weight of borate ester of polyoxyalkylene expressed by chemical formula (2) obtained by above mentioned method were blended for 5 minutes under room temperature to obtain a mixture, then the mixture was thrown into a continuous blending extruder (made

by K. C. K. Company Ltd., machine name K. C. K 80×2-35 VEX type) to produce ~~the~~ resin ~~contaminant~~ composition for purging away a contaminant ~~as~~ in a pellet form having a length of 3 mm and a diameter of 3mm. ~~thereafter~~

The resin composition was named ~~there~~ ~~after~~ purge resin composition (1). ~~evaluator~~

Subsequently, the purging effect ~~value~~ ~~ation~~ test was conducted by following ~~procedures~~ ~~procedure~~

~~Dry-blend~~ <sup>Adry-blend</sup> was prepared by blending 95 kg of <sup>noncolored</sup> ~~uncoloured~~ low density polyethylene ~~pellets~~ (made by Toso Company Ltd., PETLOSENE 183) with 5kg of ~~colour~~ master batch (made by Tokyo Ink Company Ltd., PEX 3152, ~~blue~~ <sup>colored</sup> ~~coloured~~). Then the obtained dry-blend of 100kg <sup>was</sup> thrown to <sup>the</sup> hopper of the ~~the~~ extuder having a 65mm diameter screw. Then the dry-blend <sup>was</sup> fed into the extruder to be heat-kneaded.

After 100kg of <sup>the</sup> dry-blend were passed through the extruder, the purge resin composition (1) for purging away ~~contami~~ ~~contaminants~~ of the present invention obtained by above mentioned method <sup>was</sup> fed to the same extruder and passed through ~~the~~ <sup>until</sup> the ~~said~~ ~~purge~~ ~~resin~~ ~~composition~~ <sup>color</sup> till the residue of above mentioned ~~colour~~ master batch which <sup>was</sup> stuck or adhered to the <sup>surface</sup> of the screw and barrel <sup>was</sup> purged. ~~decolourization~~

This procedure is called as ~~decolouri~~ <sup>the</sup> ~~zation~~.

As the blank test, <sup>the</sup> ~~decolourization~~ test were conducted except that the resin composition for purging away ~~con~~ ~~contaminants~~

taminant of the present invention was exchanged ~~by~~ <sup>for</sup> the non-coloured linear low density polyethylene ~~pellet~~ <sup>pellets</sup> (made by Toso Company Ltd., FS240A).

Also, comparative ~~purge~~ resin <sup>composition</sup> I and comparative ~~purge~~ resin <sup>composition</sup> II were prepared for comparative ~~decolourization test~~ <sup>decolourization test</sup>, which were equivalent to the conventional ~~purge~~ resin composition as described in the above "Description of the Related Art" section.

#### Description

##### Comparative purge resin composition I

Resin composition consisting 99.0 weight % of high pressure low density polyethylene (made by Nippon Unicar Company Ltd., melt massflow rate 1.2 g/10 min., density 0.923 g/cm<sup>3</sup>) and 1.0 weight % of poly(9)oxyethylene nonylphenyl ether.

##### Comparative purge resin composition II

Resin composition consisting 99.0 weight % of high pressure low density polyethylene (made by Nippon Unicar Company Ltd., melt massflow rate 1.2 g/10 min., density 0.923 g/cm<sup>3</sup>) and 1.0 weight % of poly(11)oxyethylene dodecylether sodium sulfate.

##### Result of decolorization of purge resin composition (1)

Each purge resin resin composition amount used till decolorization were observed

rved were as follows.

• Purge resin composition (1)

of the present invention 22 kg

• Blank test 280 kg

• Comparative purge resin composition I 250 kg

• Comparative purge resin composition II 230 kg

According to the above result, it was recognized that the purge resin composition (1)

was excellent compared to the comparative purge resin composition, compositions

because the used amount of purge resin composition (1) was about 10% of the used amount of conventional type purge resin composition resulting to achieve cost

and time saving.

Savings

#### Example 2

Borate ester of polyoxyalkylenes expressed by chemical formula (8) was obtained by following synthesis process.

In a 7000 ml flask equipped with three inlet pipes and displaced by nitrogen gas were charged 146g (1 mole) of triethyl borate  $[B(OC_2H_5)_3]$ , 1.2g of dibutyl tin dilaurate and 50ml of benzene.

Subsequently, to the solution in the flask was added with 756g (3 mole) of pentylethylene glycol monomethyl ether under stirring conditions to obtain a uniform blended solution.

Subsequently, the solution in the flask was stirred for 13 hours at 95°C under the condition of distillation to

↑  
conditions

byproduct

remove ~~of~~ ethanol and benzene as the ~~by~~  
~~product~~ <sup>and</sup> to obtain 758g (0.99 mole) of a  
borate ester of polyoxyalkylene ~~expressed~~  
~~seed~~ by chemical formula (8).

In a vessel, 99.0 parts by weight of a high pressure low density polyethylene (made by Nippon Unicar Company Ltd., melt mass flow ~~rate~~ 1.2g/10 min., density 0.923g/cm<sup>3</sup>) and 1.0 parts by weight of borate ester of glycol ether expressed by chemical formula (8) obtained by above mentioned method and 1.0 parts by weight of polyoxyethylene (9) lauryl amine were blended for 5 minutes <sup>at</sup> room temperature to obtain <sup>a</sup> mixture. Then the <sup>a</sup> mixture was thrown into the <sup>a</sup> continuous-blending-extruder (made by K. C. K. Company Ltd., machine name K. C. K 80×2.35 VEX type) to produce the resin composition for purging away ~~of~~ contaminant <sup>as</sup> in a pellet form having a length of 3mm and a diameter of 3mm.

The resin composition was named thereafter <sup>hereafter</sup> ~~purge~~ resin composition (2). <sup>evaluati</sup>

Subsequently, the purging effect ~~value~~ test was conducted by following procedures. <sup>A</sup> dry-blend

Dry-blend was prepared by blending 95 kg of <sup>noncolored</sup> low density polyethylene <sup>polyethylene</sup> pellet (made by Toso Company Ltd., PETLOSENE 183) with 5kg of color master batch (made by Tokyo Ink Company Ltd., PEX 3152, blue <sup>colored</sup>) <sup>colored</sup>. Then the obtained dry-blend of 100kg were <sup>was</sup> thrown to the hopper of the <sup>a</sup> extuder having a 65mm diameter screw, then the dry-blend were <sup>was</sup> fed into the extuder to be heat-kneaded.

After 100kg of dry-blend were passed through the extruder, the purge resin composition (2) for purging away contaminant of the present invention obtained by above mentioned method ~~was~~ <sup>was</sup> fed to the same extruder and passed through the said purge resin composition (2) till the residue of above mentioned colour master batch which ~~were~~ <sup>was</sup> stuck or adhered to the ~~surface~~ <sup>surface</sup> of the screw and barrel were purged.

#### Result of decolorization of purge resin composition (2)

Each purge resin amount used till ~~decolorization~~ <sup>decolorization</sup> were observed were as follows.

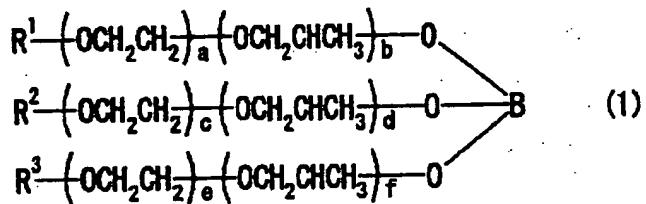
- Purge resin composition (2) of the present invention ..... 20 kg
- Blank test ..... 280 kg
- Comparative purge resin composition I ..... 250 kg
- Comparative purge resin composition II ..... 230 kg

According to the above result, it was recognized that ~~can be seen~~ <sup>the</sup> purge resin composition (2) of present invention was excellent compared to the other purge resin, because ~~use the used amount of purge resin composition~~ <sup>results</sup> of the present invention was about 10% of the ~~used amount of conventional purge resin composition~~ <sup>used</sup> ~~composition used~~ resulting to achieve cost and time saving. ~~days~~

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WHAT IS CLAIMED IS

1. A resin composition for purging away contaminant in the plastic processing machine comprising
  - (A) 100 parts by weight of a thermoplastic resin
  - (B) 0.1-10 parts by weight of a borate ester of polyoxalkylene expressed by the following general formula (1)



wherein  $R^1$ ,  $R^2$  and  $R^3$  are independently selected from group consisting of hydrogen and hydrocarbon group,  $a$ ,  $b$ ,  $c$ ,  $d$ ,  $e$  and  $f$  are positive integers independently from 0 to 30 whose sum is from 6 to 80.

2. A resin composition for purging away contaminant in the plastic processing machine according to claim 1, which further comprising

(C) 0.1-10 parts by weight of an aminogroup containing compound.

3. A purging method of a contaminant in the plastic processing machine by passing the resin composition of claim 1 or 2 through inside of said plastic processing machine.

## ABSTRACT

Disclosed is a resin composition for purging away contaminant in the plastic processing machine and a purging method of a contaminant in the plastic processing machine using the resin composition.

The resin composition comprises a thermoplastic resin and borate ester of polyoxyalkylene.